

At a Glance

What is it?

■ The Carbon Nanotubes (CNT) program seeks to improve the mechanical, thermal and electrical properties of polymer composites via incorporation of CNTs, with a focus on mechanical properties enhancement.

How does it work?

■ By developing new methods of growing, un-roping, purifying, functionalizing, dispersing and texturing CNTs in polymers, researchers are able to enhance the mechanical properties of this new class of polymer composites.

What will it accomplish?

■ The CNT Nanocomposites program is working to develop a new class of structural composites with extraordinary mechanical properties.

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The US Navy has been increasing the use of polymer composite materials (PMC) on ships and aircrafts for the last 40 years. As a result of significant investments by ONR in this materials research area, large technology demonstrators have found their way into ships such as the Advance Enclosed Composite Mast, the ¼ Scale Corvette, the Composite Helicopter Hanger, the Director Room program and the Composite Rudder. As a result of these demonstrators and other advances in PCM, a significant portion of the Navy new destroyer DDG1000 superstructure will be made out of PMCs. Despite all their advantages in terms of low weight, high-strength, stiffness, fatigue resistance and corrosion resistance, reparability, low part count, as well as low acoustic, magnetic and thermal signatures these materials have some significant weaknesses.

The main technical barrier for Carbon Nanotubes (CNT) Nanocomposites is growing very long (continuous growth would be preferred), defect-free CNTs that have a controlled diameter, and the dispersion of the CNTs into structural resins.

The warfighter payoff of improved composite technologies are tremendous since they would allow for the development of stiffer, stronger, tougher composite structures with improved performance at elevated temperature without the risk of fire for next generation ships, submarines and aircrafts. This would translate into faster, more agile, with longer range capability ships, with improved electromagnetic interference, thermal and acoustical signatures.

Research Opportunities:

- Develop new approaches to incorporate CNTs in composites to achieve new, extraordinary mechanical properties.
- New tools are needed to characterize CNT chemical, physical and mechanical properties.
- Develop new methodologies for making long, pure and cost effective CNTs.
- Many challenges exist in terms of chemistry, dispersion, consolidation and scaling up.

